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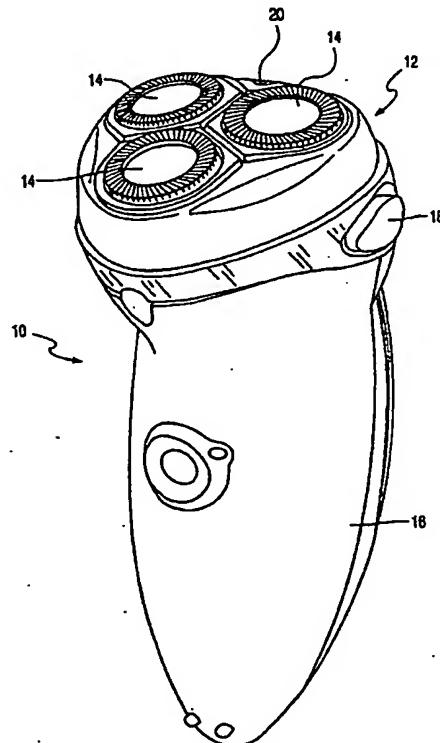
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(71) Applicant: KONINKLIJKE PHILIPS ELECTRONICS N.V. [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).		
(71) Applicant (for SE only): PHILIPS AB [SE/SE]; Kottbygatan 7, Kista, S-164 85 Stockholm (SE).		
(72) Inventors: VAN OPZEELAND, Johannes, Bernardus, Valentines; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL). RIJKEN, Martinus, Maria; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL). KLOK, Jan; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).		
(74) Agent: STOLK, Steven, A.; Internationaal Octrooibureau B.V., P.O. Box 220, NL-5600 AE Eindhoven (NL).		

(54) Title: SHAVING SYSTEM WITH TEMPERATURE INDICATOR

(57) Abstract

A shaving system (10) is described, which is provided with a temperature indicator, indicating whether a sufficiently high cleaning temperature is reached when the shaving system is rinsed with water, which is necessary to remove shaving liquid and/or skin grease and oils from the shaving head (12). The temperature indicator comprises a synthetic resin, such as polyoxymethylene, blended with a reversible thermochromic coloring material. Visible inner or outer parts of the shaving system, especially those of the shaving head, can be made of such a blended synthetic resin, so that these parts act as a temperature indicator. In a typical example, the synthetic resin comprising the reversible thermochromic material has a color-change temperature of 58 °C, and shows a reversible color transition from blue to green.



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## Shaving system with temperature indicator.

The invention relates to a shaving system comprising moulded synthetic resin parts. Shaving systems include electric shavers, manual razors and depilating devices. A number of types of these shaving systems is waterproof and suitable for use in combination with water and/or shaving liquids. Such a shaving liquid or depilatory substance is applied to 5 the surface of the skin, before and during shaving or removing unwanted hairs with the shaving system, for the purpose of conditioning the skin so that it feels soft, smooth and moisturized, for lubrication, and to improve the shaving effect.

An example of a shaving system is disclosed in US-A-5,402,697. The known shaving system comprises an electric shaving apparatus and a cartridge filled with a 10 shaving liquid (a depilatory substance). The cartridge has an actuating button for dispensing the shaving liquid. It is important for this shaving system, and for those mentioned above, that the shaving system can be adequately cleaned. Especially residues of the shaving liquid in combination with shaved-off beard hairs may give rise to the growth of bacteria, so that there is a risk of infection of the user of the shaving system. Although preservatives are often added 15 to shaving liquids, the results are not always satisfactory. An increase of the amount of preservative in the shaving liquid could give rise to skin irritation.

Such shaving systems, including manual razors of the wet shave type and depilators, which are waterproof may be cleaned by rinsing with water. Rinsing with water at room temperature often leads to unsatisfactory results. Especially skin grease and oil are 20 difficult to remove from the shaving system. Experiments have shown that a good cleaning result is obtained with water of a sufficiently high temperature, i.e. about 60°C. However, the user does not know what the water temperature is, nor what the temperature of the rinsing water should be.

It is an object of the invention to provide a shaving system which indicates 25 to the user the moment when the cleaning operation by rinsing with water is effectively accomplished.

According to the invention this object is achieved by a shaving system as specified in the opening paragraph, which is characterized in that at least one synthetic resin

part of the shaving system comprises a reversible thermochromic coloring material having a color-change temperature above room temperature. Examples of synthetic resin parts include the shaving head, hair chamber, bracket, blade seat, guard bar, skin-engaging surface, and walls of the housing. Preferably those parts which are easily soiled comprise a reversible 5 thermochromic coloring material. The synthetic resin part will change its color when it comes into contact with warm or hot water at a temperature which is at least necessary for a good cleaning result. The color-change temperature which indicates the minimal cleaning temperature can be found by experiment, and depends inter alia on the applied shaving liquid, cosmetic agent or shaving aid, such as a lubricant. In a preferential embodiment, the color- 10 change temperature is chosen between 40 and 100°C, more preferably between 55 and 65°C. The use of water within this temperature range generally results in the shaving system being properly cleaned. Moreover, this temperature is widely available, e.g. bathrooms with tap water heated by an electrical or gas water-heater or boiler. Preferably, the color in the high-temperature state is green, indicating a sufficiently high cleaning temperature. Due to its 15 reversible character, after cooling to below the color-change temperature, the thermochromic material will return to its original color.

Synthetic resins having reversible thermochromic properties are known as such, and are commercially available. The synthetic resin comprises a thermochromic coloring material, which is added to the synthetic resin either singly or together with a usual dye or 20 pigment.

There are several thermochromic coloring materials such as metal complex salt crystals, and liquid crystals. A preferred colating material is the material which comprises a mixture containing an electron-donating chromogenic material, an acidic substance, and preferably a solvent. Especially the latter are preferred, because of the availability of a wide 25 range of colors and color-change temperatures. Examples of the latter are described in US-A-5,431,697.

The electron-donating chromogenic material includes triphenylmethane phtalide compounds, phtalan compounds, diphenyl methane compounds, fluoran compounds, spiropyran compounds, etc.

30 The acidic substance includes 1,2,3-benzotriazole compounds, phenol compounds, thiourea compounds, alkyl- and aryl phosphates, etc.

The solvent includes alcohols, esters, azomethines, etc.

Specific examples of electron-donating chromogenic materials, acidic substances and solvents are disclosed in US-A-5,431,697 mentioned above. The electron-donating chromogenic material governs the color of the thermochromic coloring material. The use of a solvent renders the material responsive to changes in temperature and causes the 5 sensitivity and definition to be increased. The proportion and the type of chromogenic material, acidic substance and solvent determine the intensity of the color, the color-change temperature, and the colors obtained at temperatures below and above the color change temperature.

Preferably, the three components of the thermochromic coloring material 10 are microencapsulated, in order to maintain an effective combination during blending with the synthetic resin and shaping of the synthetic resin into parts. Microencapsulation can be carried out by known methods, such as interface polymerization, in situ polymerization and other techniques. Such processes enable, microcapsules including the thermochromic coloring material and having a diameter of 1 to 50 Fm to be obtained. Microencapsulated 15 thermochromic coloring material is commercially available.

The thermochromic coloring material, whether microencapsulated or not, is dispersed in the synthetic resin to be used. Examples of the synthetic resin include polyacetal resin, polyamide resin, polyester resin, polycarbonate resin, polystyrene resin, polyethylene resin (PE), polypropylene resin (PP), acrylic resin and polyacetal, also called 20 polyoxymethylene (POM).

As organic thermochromic coloring material is sensitive to thermal degradation at temperatures above about 240°C during moulding of the synthetic resin, a synthetic resin is preferred which has a relatively low processing temperature, such as PE, PP and POM. Moreover, these resins are resistant to usual cleaners and pre- and aftershaves. For 25 those parts of the shaving system which are subject to a mechanical load, POM is preferably used because of its Young's modulus, which is twice as high as that of PE and PP.

In a preferred embodiment, the thermochromic coloring material is present in the synthetic resin in an amount of 0.3 to 10% by weight. Amounts below 0.3% would fail to produce a noticeable color change. Amounts above 10% have no increased effect and could 30 adversely affect the mechanical strength of the synthetic resin.

After dispersing, the blend may be granulated into pellets, beads and the like. The synthetic resin parts of the shaver can be manufactured by injection molding, extrusion molding, blow molding and other usual molding processes.

The measure according to the invention can be effectively used in shaving systems which are waterproof and suitable for cleaning with water. These shaving systems include manual razors, electric rotating shavers, electric vibrating shavers, and depilators.

The invention can be advantageously used in electric shavers which have a 5 built-in shaving liquid reservoir, such as those described in the above-mentioned US-A-5,402,697 and in the non-prepublished international patent application IB 97/00992 (PHN 16488) the latter being filed by Applicants. In those shavers there is a risk of soiling with residues of the shaving liquid and skin grease and oils, which could give rise to growth of bacteria.

10 The invention will be further elucidated with the aid of an exemplary embodiment, and the accompanying drawing, wherein:

Figure 1 is a perspective view of an electric shaver according to the invention.

### 15 Exemplary embodiment

Figure 1 shows a perspective view of a waterproof electric shaver 10 of the rotating type, comprising a treatment device for carrying out a shaving operation under the influence of a fluid. The shaver 10 comprises a shaving head 12 having three shaving units 14 each containing a rotatable cutter (not shown). The shaving head 12 is detachable with respect 20 to the shaver 10, so as to give access to the hair chamber (not shown). The housing 16 accommodates a reservoir with shaving liquid, and a pump (both not shown). A push-button 18 activates a pump (not shown) which causes the shaving liquid to be discharged from an outlet opening 20 in the shaving head 12.

Several synthetic resin parts of the interior or exterior of the shaving unit 25 12, which are visible to the user, may be manufactured from synthetic resin blended with reversible thermochromic coloring material, e.g. the rim of the shaving head 12, the inner bracket supporting the shaving units 14, the hubs of the rotatable cutters, or the coupling pins connecting the electric motor and the hubs of the rotatable cutters.

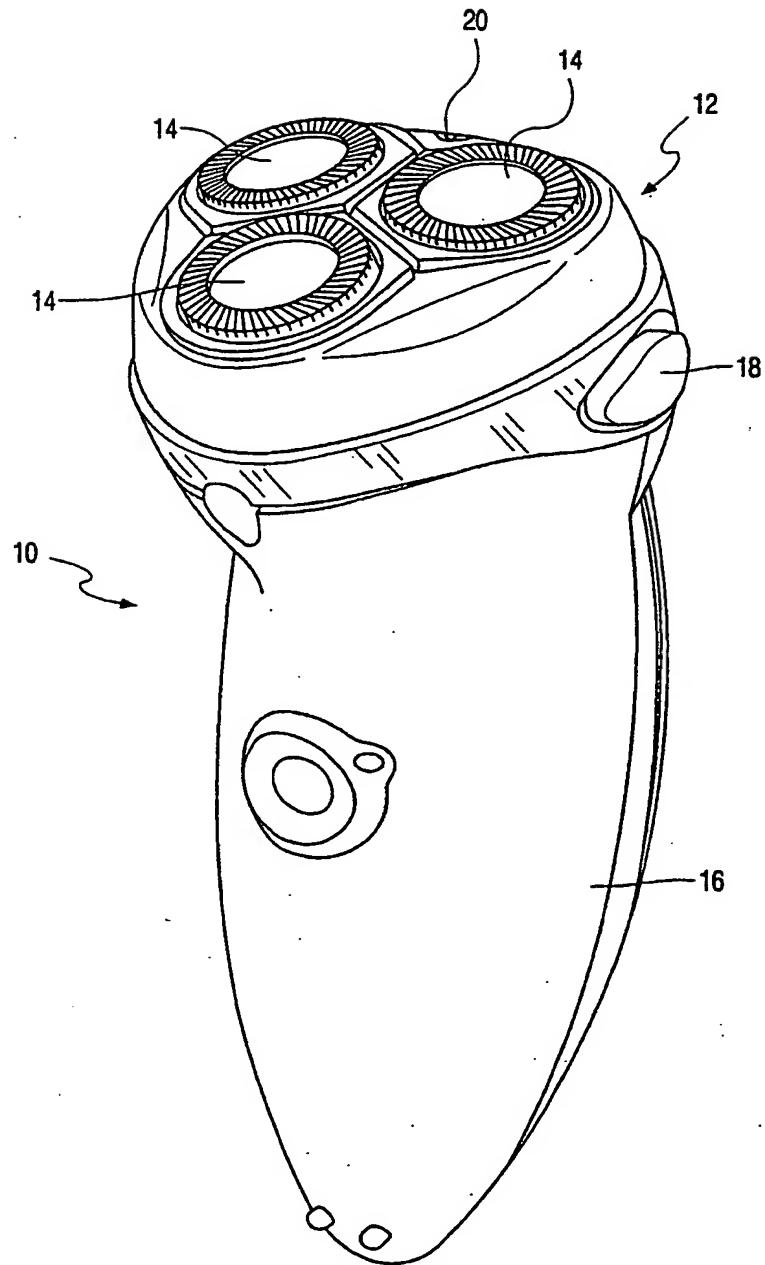
A suitable synthetic resin with reversible thermochromic coloring material 30 is manufactured by mixing polyoxymethylene (supplier Hoechst) as the synthetic resin with 5 % by weight microencapsulated thermochromic coloring material having a color-change temperature of 58°C (supplier Matsui Shikiso Chemical Co.). This material exhibits a color transition from blue to green when heated above 58°C. Upon cooling, the blue color returns.

According to the invention a shaving system is provided having a temperature indicator, indicating whether a sufficiently high cleaning temperature is reached when the shaving system is rinsed with water of increased temperature, which is necessary to remove shaving liquid and skin grease and oils from the shaving head. The temperature indicator comprises a synthetic resin mixed with a reversible thermochromic coloring material. Visible inner or outer parts of the shaving system, especially those of the shaving head, can be made of such a blended synthetic resin, so that these parts act as a temperature indicator.

## CLAIMS

1. A shaving system comprising moulded synthetic resin parts, characterized in that at least one synthetic resin part comprises a reversible thermochromic coloring material having a color-change temperature above room temperature.
2. A shaving system as claimed in Claim 1, characterized in that the color-change temperature is between 40 and 100°C.
3. A shaving system as claimed in Claim 1, characterized in that the color-change temperature is between 55 and 65°C.
4. A shaving system as claimed in Claim 1, characterized in that the thermochromic coloring material is microencapsulated.
5. A shaving system as claimed in Claim 4, characterized in that the thermochromic coloring material is present in the synthetic resin in an amount of 0.3 to 10 % by weight.
6. A shaving system as claimed in Claim 1, characterized in that the synthetic resin is a polyacetal resin.
7. A shaving system as claimed in Claim 1, characterized in that the shaving system is an electric shaver comprising a reservoir filled with a shaving liquid and means for dispensing the shaving liquid..

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# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/IB 98/01483

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B26B 19/40, B26B 21/44 // A61K 7/48

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B26B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPIL, EDOC

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EPOQUE, PAJ, JP62068879 A, (PILOT INK CO LTD), "THERMALLY COLOR CHANGING MATERIAL", 87-03-28 --	1-7
A	FR 2584333 A1 (CERAMIQUES TECHNIQUES DESMARQUEST), 9 January 1987 (09.01.87) --	1-7
A	WO 9604112 A1 (WARNER-LAMBERT COMPANY), 15 February 1996 (15.02.96) --	1-7
Y	GB 2312215 A (SHEEMA SEGAL ET AL), 22 October 1997 (22.10.97), page 5, line 23 - page 6, line 16; page 6, line 3 - line 4, abstract --	1,4

Further documents are listed in the continuation of Box C.

See patent family annex.

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Date of the actual completion of the international search

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**C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5431697 A (KAMATA ET AL.), 11 July 1995 (11.07.95), column 1, line 34 - line 49; column 6, line 3 - column 9, line 7, claim 5, abstract -- -----	1,4

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
**PCT/IB 98/01483**

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